REMARKS

Claims 1-7, 20 and 22 correspond to non-elected Group I and have been canceled without prejudice or disclaimer. Claims 8, 15, 19 and 21 have been amended to recite that the chitosan of the biosorbent composition has an affinity for adsorption of metals and heavy metals from the wastewater or aqueous systems. No new matter is presented in this amendment as support can be found at page 4 of the application. Claim 14 has been amended to recite "oxalic acid." No new matter is presented in this amendment as support can be found at page 6. New claims 25-32 have been added. Support can be found throughout the specification, particularly pp. 4-8.

PRIORITY

The Examiner indicates that although the claim for priority is acknowledged under 35 U.S.C. § 119 (e), support cannot be found for claims 23 and 24 and Figure 6.

The preliminary amendment, which added claims 23 and 24 and Figure 6, make explicit that which was inherent in the original specification. Perlite is a commonly known support material. Applicant submits herewith a reference that describes the use of perlite as a support material in the art before the filing date of the present application. According to *In re Wright*, 866 F.2d 422, 425, 9 U.S.P.Q.2d 1649, citing *In re Smith*, 481 F.2d 910, 178 U.S.P.Q. 620 (C.C.P.A. 1973), "the claimed subject matter need not be described in *haec verba* in the specification in order for the specification to satisfy the description requirement." The Federal Circuit concluded that the exact words introduced by amendment need not have been in the original specification. Because the preliminary amendment does not correct any fundamental defect in the original disclosure, it did not introduce any new matter. Applicant respectfully requests that the Examiner assign the earlier priority to the present application.

"DOUBLE PATENTING"

Under the heading "Double Patenting", the Office Action recites what is in essence a prolix objection to claim 14 in view of claim 13. Because neither claim has been allowed, the objection is premature. Regardless, claim 14 has been amended to specifically recite ceramic alumina or ceramic silica as a support material and to further recite that oxalic acid may be used to bind chitosan to the support material. Thus, claim 14 is no longer a duplicate of claim 13 and withdrawal of the objection under 37 C.F.R. § 1.75 is respectfully requested.

NOVELTY

Favorable reconsideration of the rejection of claims 8, 10-12, 15-19, 23 and 24 under 35 U.S.C. § 102(b) as being anticipated by Lihme et al is requested.

The rejection under 102(b) in view of Lihme et al is improper. A 102(b) rejection requires the cited reference to be "patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, *more than one year prior to the date of the application* for patent in the United States." 35 U.S.C. § 102(b). Lihme et al. issued on August 10, 1999. The instant application claims a priority date of August 1, 2000. This is less than one year from the issue date of Lihme et al. Thus, a rejection under 102(b) is improper and should be withdrawn.

In any event, the Lihme et al. patent would not anticipate the biosorbent composition of claims 8, 11, and 19 even were it to be considered prior art. Claims 8 and 19 (along with claims 15 and 21) have been amended to recite that chitosan is the material in the biosorbent that adsorbs the metals or heavy metals from the aqueous system or wastewater. This is not disclosed in Lihme.

Anticipation can only be established by a single reference which discloses each and every element of the claimed invention. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). The '442 patent (Lihme) discloses chitosans as conglomerating agents. Col. 5, lines 21-22. The chitosan conglomerating agents of Lihme are used "for carrying at least one active substance." Col.5, lines 21-22. The conglomerating agents of Lihme do nothing other than serve as carriers or supports, which must also have a certain density to control for floatation and/or sedimentation in a fluid environment. Col. 5, lines 33-42 and Col. 6, lines 27-35. Because chitosans of the present invention do not act as a support or carrier, the suspension of the composite chitosan biosorbent (CCB) in a fluid is not required, and the density of CCB can be any value relative to the fluid. (Col. 7, lines 19-55; col. 7, 56-col.-8, line 27; col. 12 lines, 15-37; col. 16, lines 8 –67; example 1, col. 27, lines 13-26). The CCB can also be used for gaseous or vapor streams. The CCB can be used in a fixed or in a fluidized bed mode, which is different from Lihme, col. 30-35.

Nor would Lihme anticipate process claims 15, 16, and 18, as amended. It is not seen how the chitosan of Lihme would function to adsorb heavy metals to treat wastewater. First, there would not be a need for an active substance if chitosan itself were used to adsorb the pollutants. Second, the chitosan is coated or surrounded by the active substance, thereby inhibiting chitosan's ability to efficiently bind metal. Instead of chitosan, the active substance in Lihme is a "microbial cell, an enzyme, a catalyst or another treatment material purifying or at least partly purifying the water." By "purifying the water", Lihme means cleaning the water of organic pollutants. For example, Lihme focuses on the removal of oil pollutants from the water. The enzymes "break down and feed on oil" pollutants in water. Col. 12, lines 15-37. Lihme neither suggests the removal of heavy metal from wastewater nor that chitosan can be used to treat wastewater. Also, Lihme does not teach the step of gel coating a support material with chitosan as in claim 16 of the present invention. The conglomerate agent, such as chitosan, is itself coated or surrounded by an active substance.

Nor would Lihme anticipate claims 10, 12, and 17 simply because Lihme teaches a ceramic support material, as alleged by the Office Action. Applicant does not claim solely the ceramic support material as his invention. Claims 10, 12 and 17 depend from the claim to the biosorbent compositions. As discussed above, Lihme does not teach the biosorbent composition of the present invention.

Nor would Lihme anticipate claims 23 and 24 simply because it teaches perlite as a support material. At col. 12, lines 30-35, the authors state that the "active substance may also comprise materials suitable for selective hydrofobic [sic] adsorption of oil, such as certain type of surface treated perlite." As indicated by the statement, Lihme uses a surface treated perlite as an active substance, not as a ceramic support material.

Claim 21 stands rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 3,635,818 ("Muzzarelli"). The Examiner indicates that Muzzarelli teaches a process for treating aqueous systems containing heavy metals with chitosan. This rejection is overcome in its entirety.

Muzzarelli teaches the use of free chitosan to adsorb metal, not a composite material of chitosan adhering to a support material as in claim 21. It teaches the use of chitosan in a free

powder form. The chitosan of Muzzarelli is useful only in chromatograph columns. The chitosan in Muzzarelli would not function in aqueous systems or waste streams (vs. a column) because the chitosan would form a gel. This probably explains why Muzzarelli teaches that wastewater is always added to the chitosan in the column. As discussed in the specification of the present application at p. 4, lines 8-15, if chitosan is used in a flow column in its natural flake form, as disclosed in Muzzarelli, gelling and associated hydrodynamic flow problems arise. Also, the metal binding sites of the chitosan are not fully exposed for adsorption in its flake form. In order to overcome these problems, the present invention coats the support material with a chitosan gel. Muzzarelli never discloses the use of chitosan with a support material.

Applicant respectfully request withdrawal of the rejection under 35 U.S.C. § 102.

NONOBVIOUSNESS

Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Muzzarelli in view of Lihme. The Examiner indicates that Muzzarelli teaches removal of heavy metals from water using chitosan, and Lihme teaches the use of perlite support material coated with chitosan for wastewater treatment.

First, Muzzarelli does not teach or suggest the use of a support material coated with chitosan. Second, Lihme uses a surface treated perlite as an active substance, not as a support material. Even if perlite is the support material, Lihme failed to teach what substance is used to treat the surface of the perlite. Lihme focuses on the removal of oil pollutants from wastewater. Thus, the substance would most likely to be an enzyme or bacteria that can break down oil, not chitosan. Lihme failed to teach or suggest the use of any active substance to remove heavy metal from wastewater. Instead, Lihme teaches the use of chitosan as a conglomerate agent that serves to carry or support the active substance, but not act as the active substance itself.

Claims 13 and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lihme in view of U.S. Patent No. 6,042,877 ("Lyon et al.") This rejection is overcome in its entirety.

Lihme teaches the use of chitosan as a conglomerate agent that serves to carry or support the active substance, but not itself be the active substance. Chitosan is coated or treated with an active substance. In wastewater treatment, chitosan, if it is chosen as the conglomerating agent, is coated with a substance that can feed on or break down oil. That substance is either a microbial cell or an enzyme, not a metal chelating agent like chitosan. If the removal of metal is preferred, and chitosan is used for this purpose, then there would not be a need to treat the chitosan with an active substance. Nevertheless, the use of free chitosan, without a support, is not effective to remove heavy metals from the wastewater. A chitosan gel would form in the aqueous media, and few, if any, metal binding sites on the chitosan would be available to adsorb the metal.

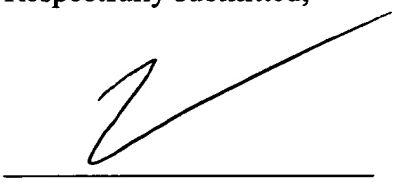
Lyon teaches the coating of a substrate with a solution of chitosan/metal ion complex. Col. 4, lines 17-20. The chitosan/metal ion complex allows the potentiator (usually an antimicrobial agent) to bind to the metal ion. Col. 4, lines 57-59. In other words, the metal ion must be present, or else the antimicrobial agent could not be bound to the substrate to create the antimicrobial article. Because the substrate is coated with a chitosan/metal ion complex, and not with chitosan alone, the resulting product cannot act as a biosorbent composition. That is, because the chitosan is already bound to the metal ion, most, if not all, of the metal binding sites are already consumed. The chitosan could not effectively adsorb heavy metal from wastewater. Moreover, Applicant does not claim the spin coating process for coating chitosan to a support material. Rather, Applicant claims the biosorbent composition, which is neither taught nor suggested in the art.

The cited references, either alone or in combination, do not render obvious the claimed invention. Applicant respectfully requests withdrawal of the rejection under 35 U.S.C. § 103(a).

CONCLUSION

Kindly consider the foregoing amendments and remarks and enter it into the record of this application. Applicant believes he has overcome or obviated all of the Examiner's rejections, and respectfully requests that the present application be allowed. Applicant's undersigned attorney may be reached at (314) 552-6443. All correspondence should continue to be directed to the below listed address.

Respectfully submitted,



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MARKED-UP VERSION OF AMENDED SPECIFICATION PAGE 4

[Chitosans] Chitosan's high affinity for metals adsorption is well documented in the literature. However, if chitosan is used in a flow column in its natural flake form, gelling and associated hydrodynamic flow problems arise due to the fact that the metal binding sites of the chitosan are not fully exposed for adsorption in its flake form. In order to overcome these problems, it has now been discovered that chitosan is coated on to a support material. It has further been discovered that support material facilitates column flow conditions and enhances mass transfer characteristics of the chitosan.

Support materials useful for the practice of the instant invention are appropriately selected so that the support material accepts and retains the chitosan gel of the instant invention for a sufficient time.

One embodiment of this invention comprises ceramic support materials coated with chitosan. Nonlimiting examples of ceramic support materials useful herein include alumina and silica (available from Aldrich Chemical Company, Inc., 1001 W.Saint Paul Avenue, Milwaukee, WI 53233-2641, USA and Sumitomo Chemical America, Inc., One California Street, Suit 2300, San Francisco, CA 94111, USA).

A preferred support material is ultra fine ceramic alumina. Such useful ceramic alumina is available from Aldrich Chemical Company. Ultrafine ceramic alumina means having the property of particle size in the range of from about 10 μ to about 150 μ.

The process for coating chitosan on to a support material of this invention comprises producing a chitosan gel, producing a support material, and coating the chitosan on to the support material. Processes such as dip coating and spin coating are useful for coating the chitosan gel on to the support material.

The process of dip coating [comprises] may comprise the steps of preparing a ceramic substrate, preparing a chitosan gel, surface coating the ceramic substrate with

chitosan, [filtration of] filtering the coated biosorbent and coating a second surface coating of chitosan on the ceramic substrate.

A substrate to be utilized for dip coating can be prepared by drying a selected substrate (such as a ceramic substrate) in an oven and then storing the dried substrate in a desiccator. This substrate then can then be mixed with an acid. After acid treatment the substrate should be washed and dried again.

A chitosan gel to be utilized for dip coating can be prepared by adding about 3 to 10 grams of medium molecular weight chitosan to 100 ml of 10 wt% acid under constant stirring and heat addition to form a viscous mixture[is formed].